



PolyUrethane Recycling Towards a Smart Circular Economy

**Smart Chemolysis: valorisation of PU
building blocks (recycled polyol, recycled
isocyanate) in flexible polyurethane foam**

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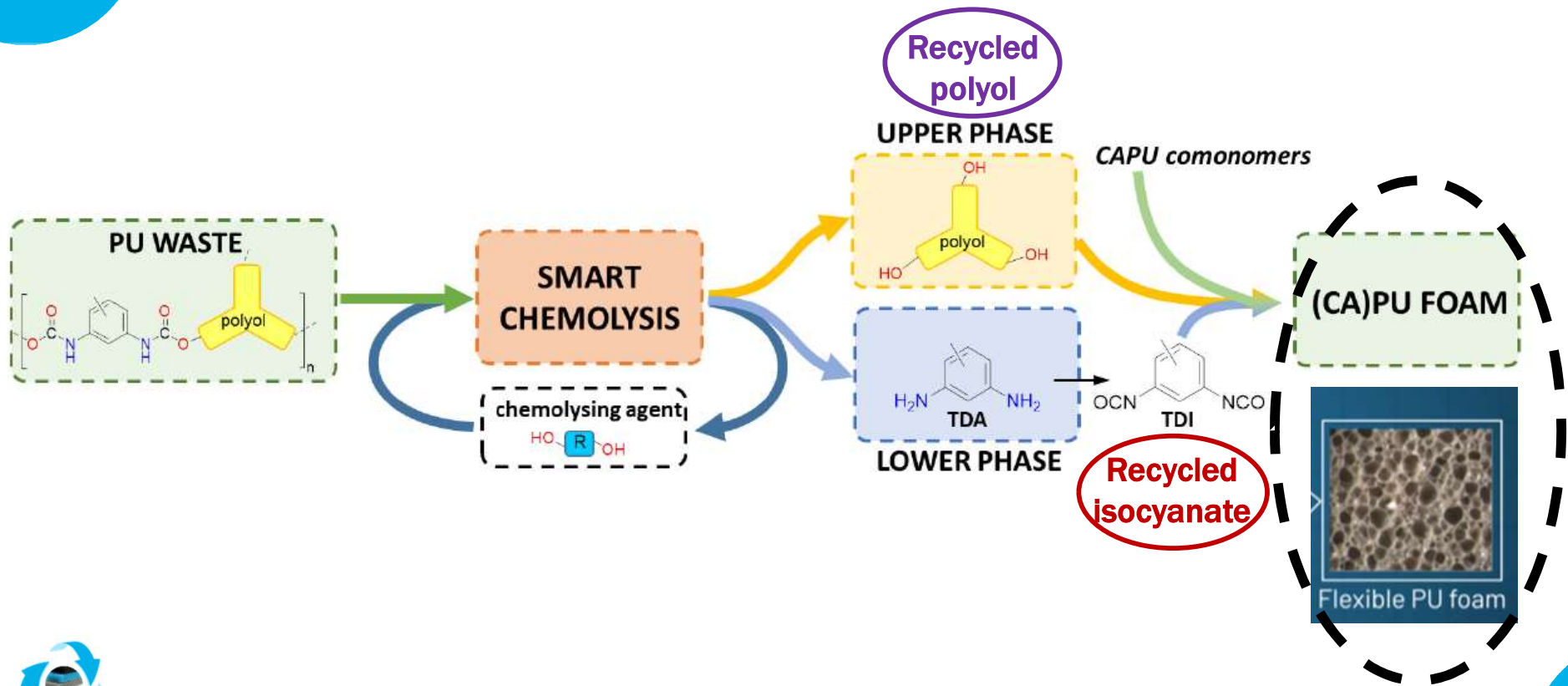


Dissemination workshop PReSmart
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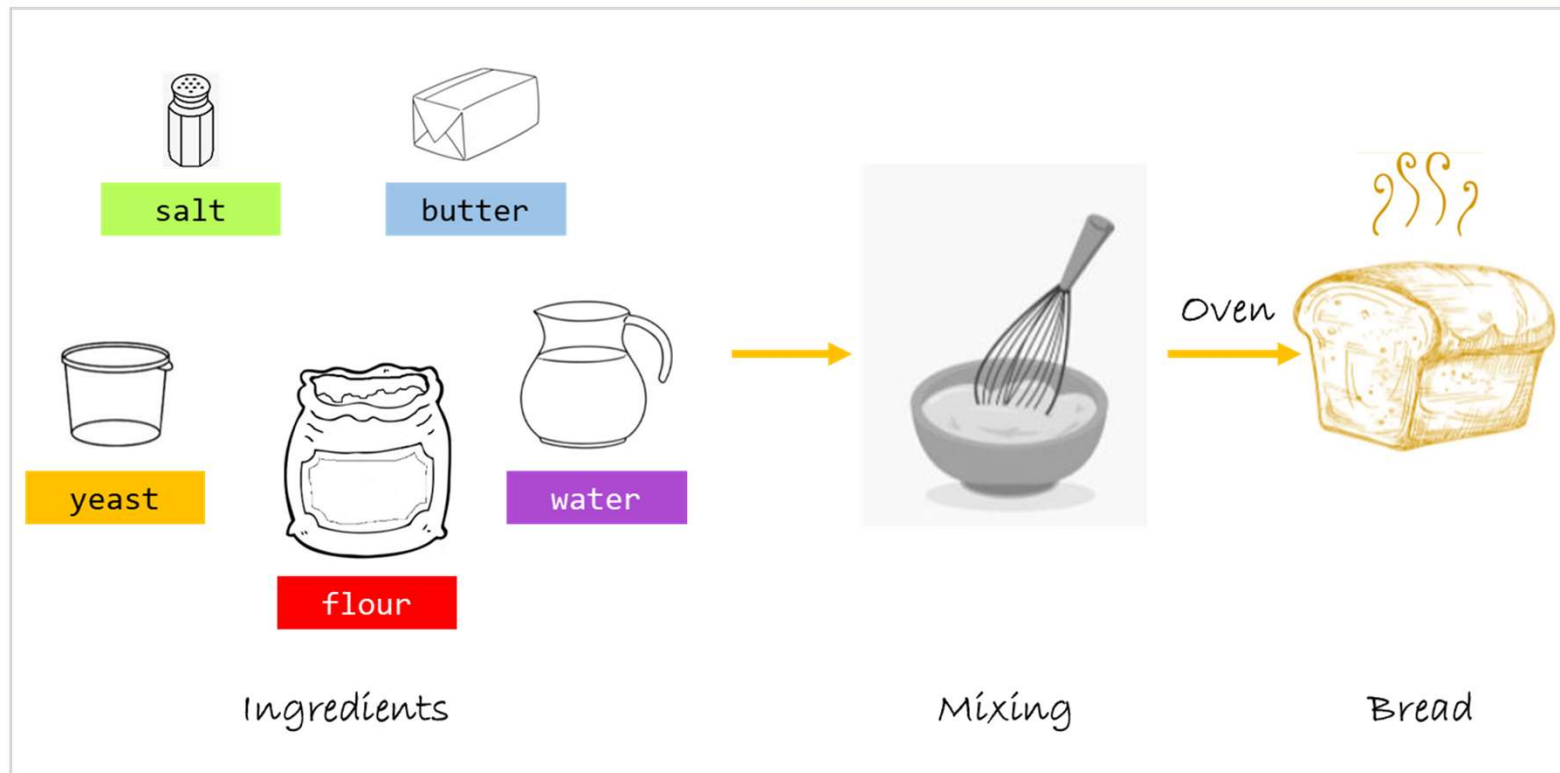
Valorisation of PU building blocks in flexible PU foam



Valorisation of PU building blocks in flexible PU foam

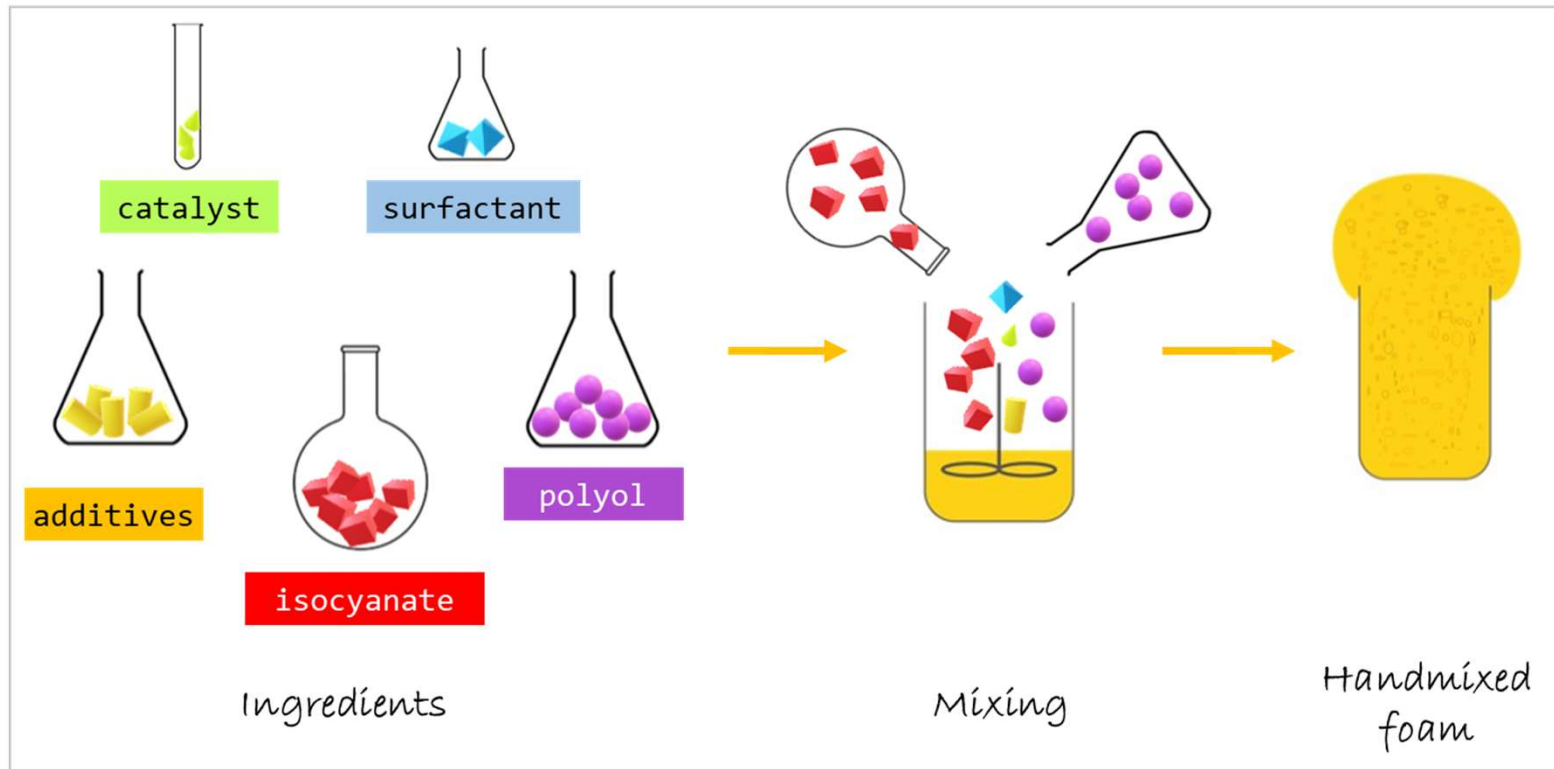
How are polyurethane foams made?

▶ Similar to making bread



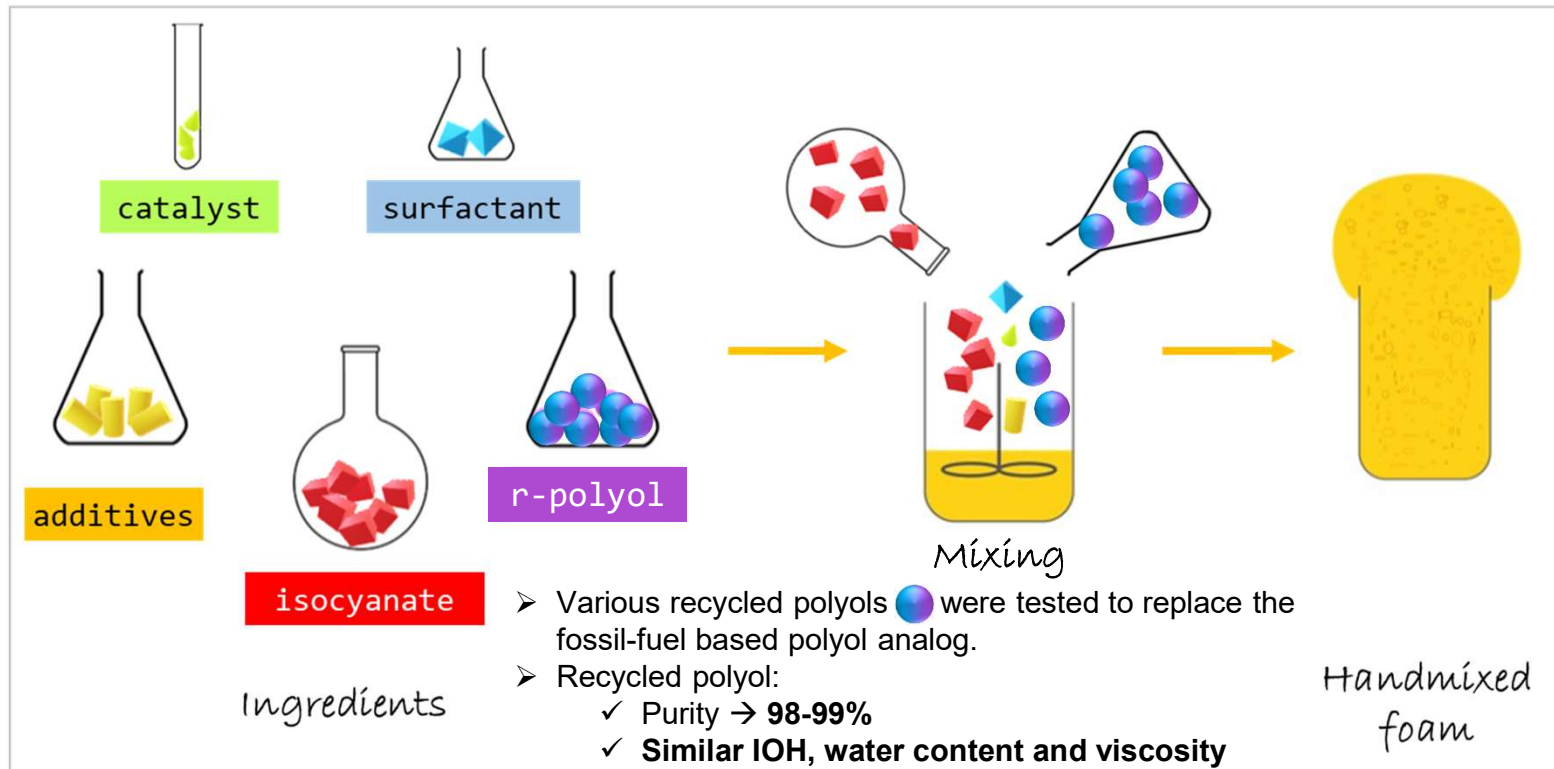
Valorisation of PU building blocks in flexible PU foam

How are polyurethane foams made?



Valorisation of PU building blocks in flexible PU foam – recycled polyol

How are polyurethane foams made?



Valorisation of PU building blocks in flexible PU foam – recycled polyol

PUReSmart recycled polyols

Comfort foam specs.	Reference (fossil fuel)	70% (lab. HM)	100% (lab. HM)	100% (semi-pilot)
Net density	✓	✓	✓	✓
Hardness	✓	✓	✓	✓
Compression set	✓	✓	✓	✓
Wet compression set	✓	✓	✓	✓
Elasticity	✓	✓	✓	✓
Tensile strength	✓	✓	✓	✓
Dynamic fatigue	✓	✓	✓	✓
Emission CertiPUR	✓	✓	✓	✓

300g (lab. scale)



10kg (semi-pilot)

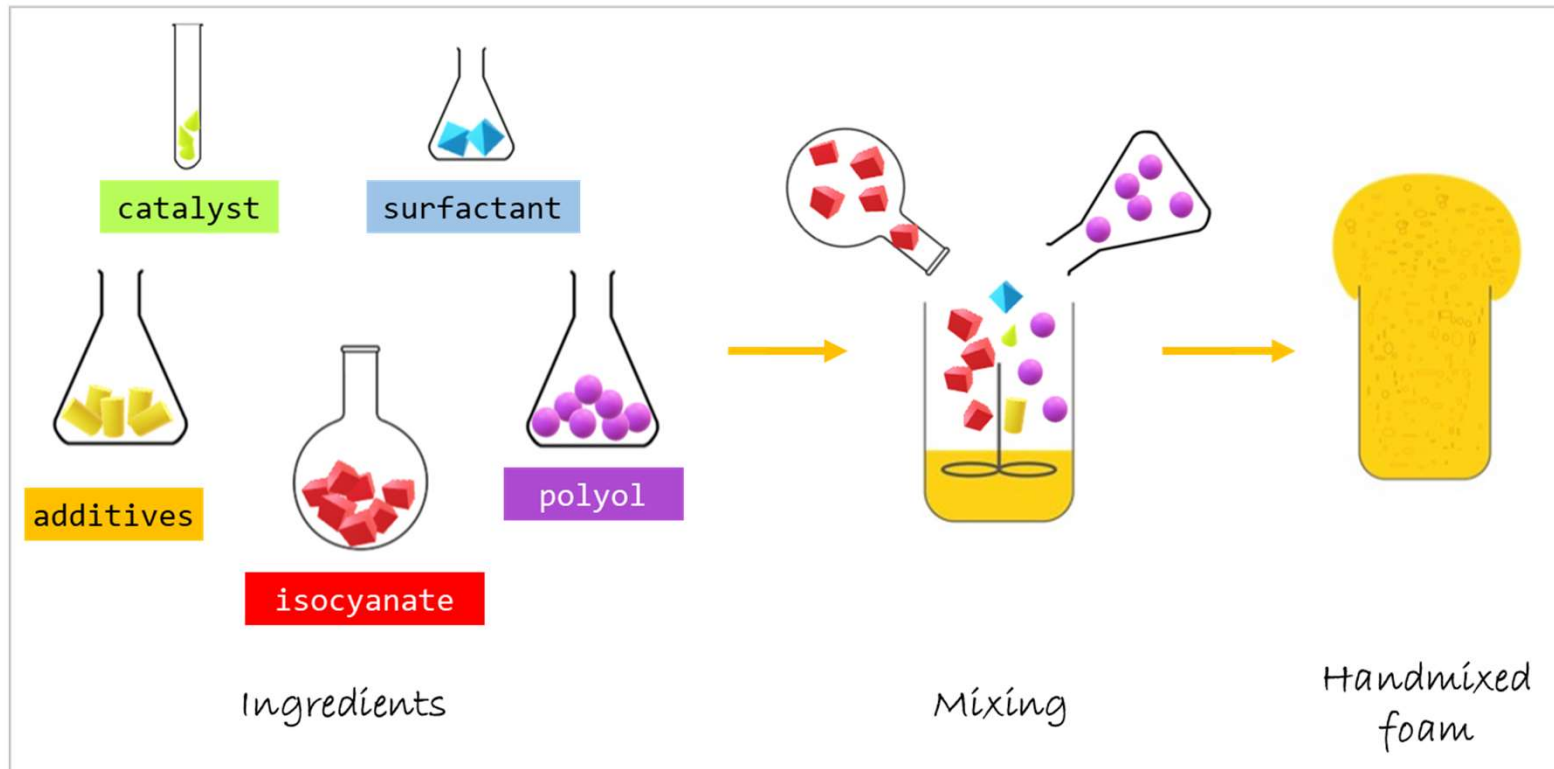


Valorisation of PU building blocks in flexible PU foam – recycled polyol

- 100% of virgin polyol in PU foam can be replaced by **100% recycled polyol** (by slightly adjusting the recipe) and the resulting foam showed **similar physical properties, satisfying the comfort foam specifications.**
- Additionally, for up to **70% recycled polyol**, PU foam properties satisfy the comfort foam specifications when compared to the reference without altering anything in the formulation.
- PU foam containing **70 or 100% recycled polyol** passed the **Certipur emission** test.
- Successful upscale from **lab. to semi-pilot** using **100% recycled polyol**, satisfying the comfort foam specifications.

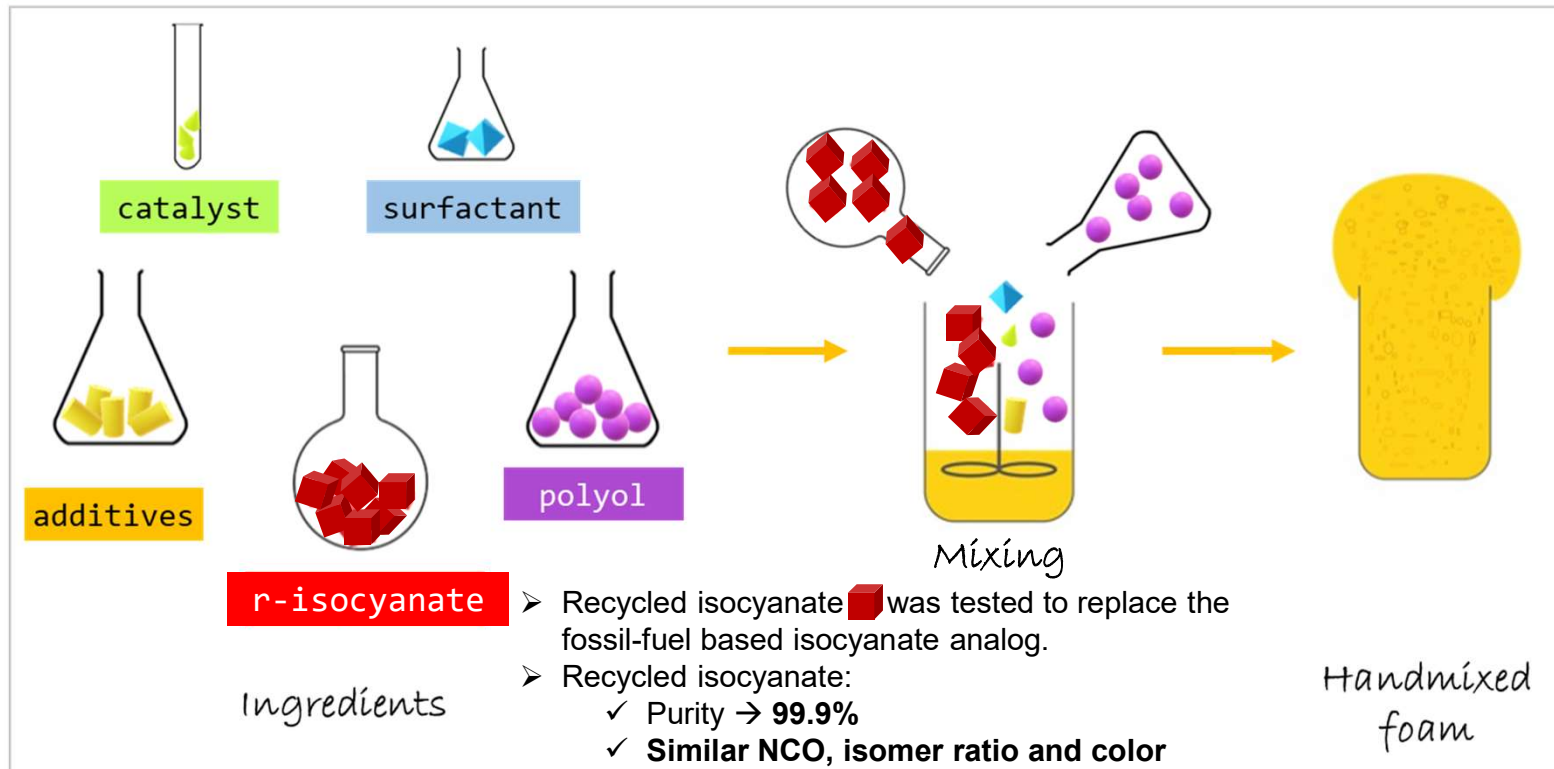
Valorisation of PU building blocks in flexible PU foam

How are polyurethane foams made?



Valorisation of PU building blocks in flexible PU foam – recycled isocyanate

How are polyurethane foams made?



Valorisation of PU building blocks in flexible PU foam – recycled isocyanate

**PUReSmart
recycled isocyanate**

Comfort foam specs.	Reference (fossil fuel)	50% (lab. HM)	100% (lab. HM)
Net density	✓	✓	✓
Hardness	✓	✓	✓
Compression set	✓	✓	✓
Wet compression set	✓	✓	✓
Elasticity	✓	✓	✓
Tensile strength	✓	✓	✓
Dynamic fatigue	✓	✓	✓
Emission CertiPUR	✓	ongoing	ongoing

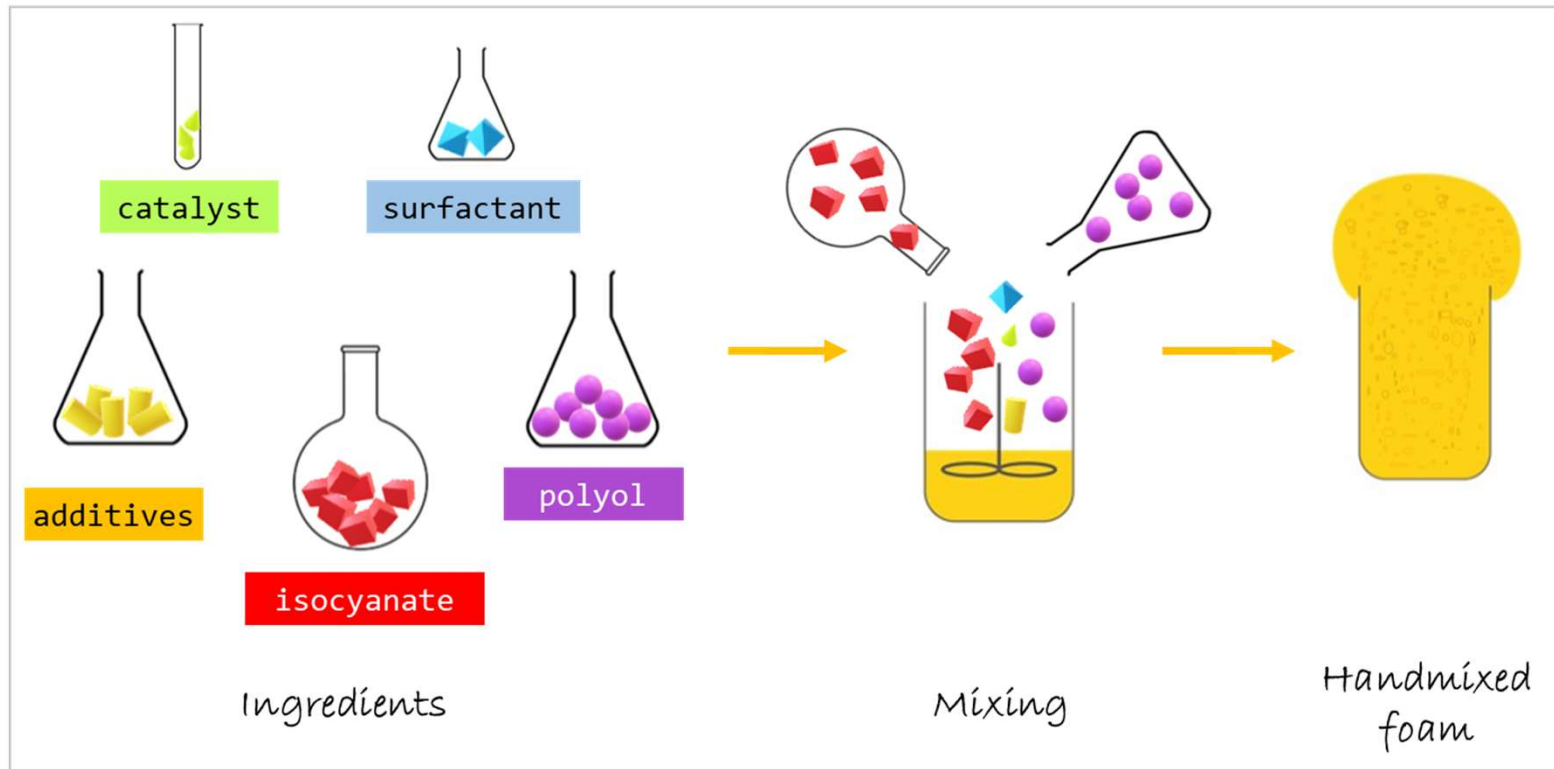


Valorisation of PU building blocks in flexible PU foam – recycled isocyanate

- 100% of virgin isocyanate in PU foam can be replaced by **100% recycled isocyanate** and the resulting foam showed **similar physical properties, satisfying the comfort foam specifications**, without altering anything in the formulation.

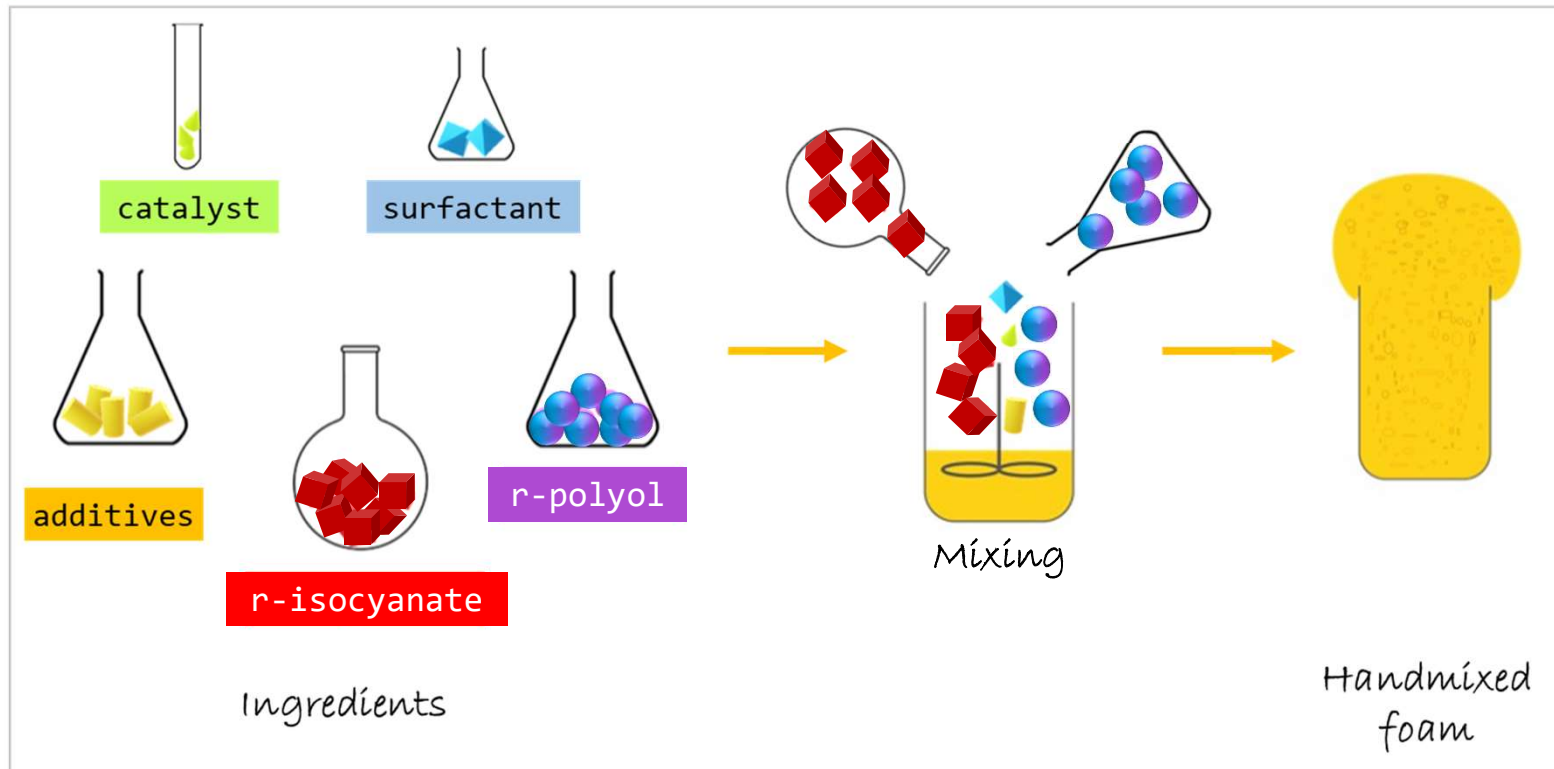
Valorisation of PU building blocks in flexible PU foam

How are polyurethane foams made?



Valorisation of PU building blocks in flexible PU foam – recycled polyol and recycled isocyanate

How are polyurethane foams made?



Valorisation of PU building blocks in flexible PU foam – recycled polyol and recycled isocyanate

PUReSmart
recycled POL & ISO

Comfort foam specs.	Reference (fossil fuel)	100% POL & 100% ISO (lab. HM)
Net density	✓	✓
Hardness	✓	✓
Compression set	✓	✓
Wet compression set	✓	✓
Elasticity	✓	✓
Tensile strength	✓	✓
Dynamic fatigue	✓	ongoing
Emission CertiPUR	✓	ongoing

Valorisation of PU building blocks in flexible PU foam – recycled polyol and recycled isocyanate

- 100% of virgin polyol and 100% of virgin isocyanate in PU foam can be replaced by **100% recycled polyol and 100% recycled isocyanate** and the resulting foam showed **similar physical properties, satisfying the comfort foam specifications.**
- **For the first time** in the PU flexible foam recycling, we can combine **both recycled polyol and recycled isocyanate** and the resulting PU foam satisfies the comfort foam specs.

➔ **Successful valorisation of PU building blocks in flexible PU foam – using 100% recycled polyol and 100% recycled isocyanate satisfying the comfort foam specifications based on  technology.**

Valorisation of PU building blocks in flexible PU foam

PUReSmart recycled polyols

Specifications (property)	Reference (fossil fuel)	70% (lab. HM)	100% (lab. HM)	100% (semi-pilot)
Net density	✓	✓	✓	✓
Hardness	✓	✓	✓	✓
Compression set	✓	✓	✓	✓
Wet compression set	✓	✓	✓	✓
Elasticity	✓	✓	✓	✓
Tensile strength	✓	✓	✓	✓
Dynamic fatigue	✓	✓	✓	✓
Emission CertiPUR	✓	✓	✓	✓

300g (lab. scale)



10kg (0.4m³)



Valorisation of PU building blocks in flexible PU foam

**PUReSmart
recycled isocyanate**

Specifications (property)	Reference (fossil fuel)	50% (lab. HM)	100% (lab. HM)
Net density	✓	✓	✓
Hardness	✓	✓	✓
Compression set	✓	✓	✓
Wet compression set	✓	✓	✓
Elasticity	✓	✓	✓
Tensile strength	✓	✓	✓
Dynamic fatigue	✓	✓	✓
Emission CertiPUR	✓	ongoing	ongoing



Valorisation of PU building blocks in flexible PU foam – recycled polyol and recycled isocyanate

PUReSmart
recycled POL & ISO

Specifications (property)	Reference (fossil fuel)	100% POL & 100% ISO (lab. HM)
Net density	✓	✓
Hardness	✓	✓
Compression set	✓	ongoing
Wet compression set	✓	ongoing
Elasticity	✓	✓
Tensile strength	✓	ongoing
Dynamic fatigue	✓	ongoing
Emission CertiPUR	✓	ongoing

